DOCUMENT RESUME

ED 380 654 CE 068 607

AUTHOR Wilson, Nancy; Goschen, Claire
TITLE Workplace Math I: Easing into Math.
INSTITUTION Colorado State Community Coll. and Occupational Education System, Denver.; Pikes Peak Community Coll., Colorado Springs.
SPONS AGENCY Office of Vocational and Adult Education (ED), Washington, DC. National Workplace Literacy Program.
PUB DATE 94
NOTE 80p.; For related documents, see CE 068 598-610.
PUB TYPE Guides - Classroom Use - Teaching Guides (For Teacher) (052)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS Adult Basic Education; Basic Skills; Behavioral Objectives; Community Colleges; High School Equivalency Programs; Job Skills; Learning Activities; Learning Modules; *Literacy Education; Manufacturing; *Mathematical Applications; *Mathematics Instruction; *Mathematics Skills; Printing; Problem Solving; Thinking Skills; Two Year Colleges
IDENTIFIERS *Workplace Literacy

ABSTRACT

This basic skills learning module includes instruction in performing basic computations, using general numerical concepts such as whole numbers, fractions, decimals, averages, ratios, proportions, percentages, and equivalents in practical situations. The problems are relevant to all aspects of the printing and manufacturing industry, with emphasis on basic measurement skills, converting fractions to decimals, reading a ruler, and figuring cost information that might be used in a customer service environment. The module includes units for six class sessions. Each unit includes the following materials: rationale, learning objectives, curriculum notes and references for the instructor, course outline, introduction, evaluations, information sheets, problems to solve, transparency masters, and pretests and posttests. Supplementary materials include a mathematics outline, a syllabus, pretest and posttest with answer keys, and handouts. (KC)

Colorado Community College and Occupational Education System
United States Department of Education
Corporate, Workforce, & Economic Development, a division of
Pikes Peak Community College
Current, Inc.

WORKPLACE MATH I:
Easing Into Math

This basic skills workplace curriculum includes instruction in performing basic computations, using general numerical concepts such as whole numbers, fractions, decimals, averages, ratios, proportions, percentages, and equivalents in practical situations. The problems are relevant to all aspects of the printing and manufacturing industry with emphasis on basic measurement skills, converting fractions to decimals, reading a ruler, and figuring cost information that might be used in a customer service environment.

Project Leader: Rita Moore

Lead Instructor: Janelle Diller

Administrative Assistant III: Cindy Blasingame

Authors: Nancy Wilson and Claire Goschen

Teachers: Nancy Wilson, Claire Goschen, Glen Goschen

Colorado Community College and Occupational Education System
United States Department of Education
Corporate, Workforce, & Economic Development, a division of
Pikes Peak Community College
Current, Inc.

INTRODUCTION

The Workplace Classroom is a set of 11 curriculum modules created by workplace educators from Pikes Peak Community College in collaboration and partnership with employees of Current, Inc., a large greeting card company in Colorado Springs, Colorado. The partnership was formed through an 18-month federal workplace research and development grant from the United States Department of Education awarded to the Colorado Community College and Occupational Education System. Teachers in the project designed, developed and field-tested curricula and materials for the 11 basic skills courses through the process of identifying and understanding the culture of the workplace and the learning needs of the individuals working within it.

The Pikes Peak staff chose not to rely on ready-made materials or programmed texts with which to teach classes. Instead, teachers and curriculum specialists interviewed employees, created job profiles, developed customized assessments, and invited student participation in the development of class content. The result is a unique set of curriculum modules in learning to learn, reading, writing, communication, problem solving, English as a second language, math and algebra that reflect learning needs of real people in a large printing/manufacturing environment. These modules were designed as six week, two hour classes, but the learning rationale and intentions could easily be modified to accommodate longer or shorter sessions.

The idea of following a design process involving the active and continuous commitment and participation of the employee and the employer provides a fresh look at the development of curricula and instruction. The goal of this process is to develop a curriculum product that enhances the basic literacy skills of adults and increases critical thinking and problem solving skills that are easily transferred to occupational improvement. The Pikes Peak staff felt that the best way to reach this goal was to involve employees and employers in the many levels of curriculum development and design.

We believe that these curriculum products are genuine reflections of sound adult learning theory that says adults must have relevant learning experiences that build on prior knowledge and in some way advance positive change in their daily work lives. These modules were built through the active participation and assessment of the adult students for whom they were designed. Those of us who developed these products encourage other workplace educators to use them in part or as complete modules, keeping in mind that their very design welcomes the change and diversity that other workplace environments are sure to lend to them. We feel that the authenticity of our curricula will provide ideas and incentive to other teachers and curriculum specialists who are beginning new programs or are looking for ways of improving existing curricula.

Best of luck with any or all of the Workplace Literacy Modules.

Rita Moore

Rita Moore, Project Leader
Workplace Literacy Grant Pikes Peak Community College

"This course helped me to get further education in math and change my job to a career".

--Math I Student

WORKPLACE MATH I: Easing Into Math

Rationale:

This approach to Math I is designed to have students interact with mathematics in some new ways. Most adult learners have a traditional math education background, characterized by paper and pencil drill and practice, rote learning and memorization, and a dry and intellectual climate. Students worked independently and quietly and discussion and verbalization of ideas was not encouraged.

While this works for many students, it fails others. Some people may not fully understand the basic ideas of place value and estimation or lack skill in number operations. More often, people approach math with a sense of discomfort or low self confidence, coupled with a high anxiety level.

Teaching adults in a basic skill math class is difficult because everyone comes to the class with a different skill and confidence level. It helps to do something that none of the students have done before, because everyone starts at the same place, nobody can coast through the sections at which they are highly skilled, and everyone must think of the ideas behind the methods rather than rely on memory and prior learning. A fresh approach is refreshing, also.

One of the most effective and enjoyable things to do is to allow the learners to communicate, both orally and in writing about the ideas they are relearning. It helps to share about previous math experiences so that the instructor knows the anxiety and confidence level of the learners. Verbalizing about our experience and conceptualizations in math is new in itself and is necessary for full understanding.

Another interesting thing to do is to use manipulatives whenever possible. This curriculum is written with this focus. It allows the student the new approach which nobody has done before, yet it is simple and effective. Many of the students will understand fractions for the first time using the pattern blocks and Cuissenaire rods. It also decreases the anxiety level of the students, because the manipulatives encourage play and experimentation. It doesn't really feel like "math" anymore.

Finally, showing students how to do number operations in a new way can really bolster their self-confidence and is an effective way to teach place value. Adding and subtracting from left to right forces students to use place value and it builds on the adult skills they have practiced when working with money. It is mathematically sound, and some students understand "carrying" and "borrowing" for the first time. They are very verbal with this new understanding and it is fun and important to encourage this communication. It solidifies the ideas.

Rita Moore
Project Leader

Nancy Wilson and Claire Goschen
Authors

WORKPLACE MATH I: Easing into Math

SESSION I

"Out of all tuition paid classes in high school and other volunteer classes - after 29 years, I finally got it, at last!"

Math I Student

Learning Intentions:

- Students will relearn place value, estimation, and addition, solve a problem in groups of 3 or 4 using logic, and discuss their workplace math needs.

Curriculum Notes:

- Curriculum notes and references follow course outline.

Course Outline:

I. Introduction

- Purpose of class/ goals: confidence and skill improvement
- Intro of students/ myself

II. Administrative Details

A. Attendance and class roster
B. Participant Data Sheets
C. 4 x 6 cards
   - name
   - work extension
   - department name and number
   - work days and hours
   - home phone (optional)
   - personal information
D. Participant learner packet
E. Portfolio

III. Writing/Share/Discuss

- Write short paragraph on a past math experience.
- Share/discuss - math anxiety?

IV. Job Skill Assessment (take notes to create assessment) Discuss

- What math do you use on job: computation, estimation, %, fractions?
- Is accuracy important/estimation/speed
- Problem solving situations using numbers?
- Sequential step by step with numbers?

V. Write:

- What math goals would you like to attain by end of course related to job?
  Improve...learn how to...feel

VI. Cuisenaire Rods

- Ways to equal 10 - create as many as you can (10 = orange)
- Discuss: how did you go about this project?
- 1 + 2 + 3 + 4 = ? show me
  2 + 4 + 6 + 8 = ? "
  6 + 7 + 8 + 9 = ? "
- Algebra extension: 5R = 10 R = ? 3G + 1 = 10
  2Y = 10 Y = ?
  10W = 10 W = ?
  R + B = 10, etc.

VI. Place Value - Addition Left to Right

- Show traditional right to left with carrying
- Show left to right by writing out partial sums.

A) 14	B) 64	C) 49	D) 49
+ 28	+ 37	+ 25	11
			+ 25
30 + 12	90 + 11	60 + 14	80 + 5 or 70 + 15

- Mental arithmetic left to right with place value.

10 + 20 + 30 + 40 = 100 20 + 40 + 60 + 80 = 200 60 + 70 + 80 + 90 = 300

A) 23	B) 21	C) 32	D) 16	E) 11	F) 16
14	42	48	18	12	17
32	63	14	12	13	18
+ 41	+ 84	+ 26	+ 14	+ 14	+ 19

VI. Place Value - Addition Left to Right Continued

G) 61 + 71 + 81 + 91

H) 22 + 14 + 33 + 41

I) 41 + 15 + 24

J) 23 + 72 + 11

K) 56 + 54

L) 37 + 43

- **Look for 10's or 100's**

11) 14 + 13 + 15 + 11

12) 43 + 57 + 15

13) 26 + 22 + 23 + 15

14) 13 + 17 + 16 + 14

15) 11 + 28 + 22 + 19

- **Partial sums. Write down if necessary, then total.**

16) 21 + 41 + 38 + 15 + 12 + 13

17) 48 + 56 + 22 + 44 + 35 + 25

18) 28 + 15 + 75 + 62 + 43 + 37

VIII. Estimation? It's at least

56 + 48

39 + 25

746 + 213

1,567 + 2,411

13,985 + 14,682

IX. Evaluation/Handout

- Daily Journal
  Students record comments about the class and how they can use their new skills on the jobs.

WORKPLACE MATH I: Easing into Math

Pretest

1. 16
   19
   + 34

2. 42 24
   10 35
   + 13

3. 408 - 199 =

4. 4421 - 2986 =

5. 1.167 + 2.34 + 0.8 =

6. 21.4 - 0.987 =

7. How many items are there if they are numbered 17-58 and none of the numbers are missing?

8. If you had to count a stack of items and the stack measured 147 rows and by 17 items high and then there were 3 remaining, how many is this?

9. 5 is to 8 as 7 is to what number?

10. What is 12.5% of 56?

11. 1/2 + 3/4 =

12. 5/6 - 2/3 =

13. 1 1/4 + 2 1/3 =

14. 3 3/4 - 1 1/6 =

15. 3 1/4 - 1 3/8 =

Curriculum Notes:

I. Administrative Details

Pre-Evaluation: Every program will have some kind of record-keeping process. The procedures we've listed have worked for us. Daily attendance sheets and class rosters are kept. Students who complete four out of the six classes receive a certificate of completion at the end of the course. Participant data sheets are federal forms that information that provides a profile of the company. Four by six cards are used by instructors to collect information that will enable them to get in touch with a student outside of class or work if necessary. The participant learner packet contains a summary brochure about the program; who they may call if they have a question about scheduling, class content, etc., an explanation of the process for claiming classtime as work hours; a copy of an individual education plan, and a sample of the certificate they may receive upon class completion.

The portfolio is a folder with paper for journaling; daily evaluation sheets; and a place for students to collect their work for their own assessment and for the instructor's assessment of their work progress.

The pre-evaluation is really a form of self-assessment. Students are asked to list goals related to the course and assign numerical weight to them. At the end of the class the cards are re-examined for progress and students again assign numerical weights to their progress. (Please see attached assessment activity explanation). Students may also take a pre/post test. Administrative details at the end of the session.

Post evaluation is linked to the goal setting and assessment activity above and/or pre and post-evaluation instruments designed by teachers. The course evaluation (attached) and instructor evaluation (attached) are designed to guide the instructional team in making curriculum modifications as well as changes in teaching strategies.

VI. Cuisenaire Rods

One way to begin the skill work is to use Cuisenaire Rods. They are blocks created for children to teach number theory. The block that represents a unit is a cubic centimeter in size if that concept is necessary in the course. The block symbolizing a 2 is really 2 of the unit blocks in size and is a different color. There are different colors of blocks to symbolize all of the numbers from 1 to 10 and the lengths are true. The 10 block is actually 10 centimeters long.

This lesson is introductory. Students study equality (create a 10 as many ways as you can), and the instructor can show the algebra extension quickly by abbreviating the colors the students used in their examples. It helps to write it for them and explain that the symbols are abbreviations. (5R = 10; 2Y = 10; etc.) They also discuss the ways they organized the challenge and actually compute special sums to be used later using the rods. The rods are a nice tool for making connections from elementary to more symbolic mathematics in a concrete way.

VI. **Cuisenaire Rods** Continued:

Place value can be taught by showing addition from left to right. What it makes obvious is the worth of a digit when it occupies a certain place. (A two in the tens place is worth 20.) It also makes very obvious what happens when "carrying" is done, which the traditional symbolism makes obscure and difficult.

Some examples:

11	16	123
+ 28	+ 28	234
----	----	+ 111
30 (from the 10's)	30 (from the 10's)	----
+ 9 (from the 1's)	+ 14 (from the 1's)	400 (100's)
----	----	60 (10's)
39 (final answer)	44 (final answer)	8 (1's)
		--- ----
		468 (final)

VI. **Place Value**

Using special sums is fun to demonstrate mental arithmetic. Choose examples that allow success. Try to build to more difficult problems with larger numbers slowly. Use left to right addition along with these special sums. (1+2+3+4, 2+4+6+8, 6+7+8+9)

Examples:

16	16	32	61
18	17	48	71
12	18	14	81
+ 14	+ 19	+ 26	+ 91
----	----	----	----
40(10's)	40(10's)	100(10's)	300(10's)
20(1's)	30(1's)	20(1's)	4(1's)
----	----	----	----
60 (final)	70 (final)	120 (final)	304 (final)

Writing the subtotal from each column is helpful at first, then it will be okay to transfer into mental arithmetic. This is place value practice really, but when people get really comfortable it is fun to watch how excited they get when they can add 7 or 8 two or three digit numbers in their heads.

Practice doing estimates also by asking "the sum is at least...". The subtotal of the largest place value column is also the estimate.

Class: _____

Date: _____

Instructor: _____

	Name	Dept. Number	S. S. Number
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
21.			
22.			
23.			
24.			
25.			
26.			
27.			
28.			
29.			
30.			
31.			

SKILLS FOR A COMPETITIVE WORKFORCE
PARTICIPANT DATA SHEET

Please fill out the following information. Print or write clearly. This information will be used for demographic and statistical purposes only.

SECTION I (Identification)

Name:_____ Social Security Number: ___-___-_____
Last Name, First Name Middle Initial

Street Address:_____ City:_____ Zip Code:_____

Phone Number: (___) ___-____

Department: _____ Position:_____

SECTION II (demographic information)

1. Yrs. with company (circle one): a. unemployed b. 0-5 c. 6-10 d. 11-15 e. over 16

2. Age: __ 3. Sex: M F

4. Ethnicity (circle one): a. White b. Black c. Hispanic d. American Indian/Alaska Native e. Asian/Pacific Islander f. Other

5. Single: Y N
Head of Household: Y N

6. Is English your second language? Y N

7. Participating in (circle one or more):
   a. Basic Skills Program
   b. GED Program
   c. ESL Program

SECTION III (outcome information)

Assesment Planning:

8. Course Title:_____ (check one: ___ Basic Skills, ___ GED, ___ ESL)

	Goals	Assessment Tool	Pre-Asses Results	Post-Asses Results	Improved
9.	Test Higher on Basic Skills: _____				Y N
10.	Improved Communication Skills:				Y N
11.	Increased Productivity:				Y N
12.	Improved Work Attendance:				Y N
13.	Increased Self-Esteem:				Y N

14. Contact Hours: ___ ___ ___ ___

15. Course Title:_____ (check one: __ Basic Skills. __ GED. __ ESL)

	Goals	Assessment Tool	Pre-Asses Results	Post-Asses Results	Improved
16.	Test Higher on Basic Skills: _____				Y N
17.	Improved Communication Skills:				Y N
18.	Increased Productivity:				Y N
19.	Improved Work Attendance:				Y N
20.	Increased Self-Esteem:				Y N

21. Contact Hours: __ __ __ __

22. Course Title:_____ (check one: __ Basic Skills. __ GED. __ ESL)

	Goals	Assessment Tool	Pre-Asses Results	Post-Asses Results	Improved
23.	Test Higher on Basic Skills: _____				Y N
24.	Improved Communication Skills:				Y N
25.	Increased Productivity:				Y N
26.	Improved Work Attendance:				Y N
27.	Increased Self-Esteem:				Y N

28. Contact Hours: __ __ __ __

29. Course Title:_____ (check one: __ Basic Skills. __ GED. __ ESL)

	Goals	Assessment Tool	Pre-Asses Results	Post-Asses Results	Improved
30.	Test Higher on Basic Skills: _____				Y N
31.	Improved Communication Skills:				Y N
32.	Increased Productivity:				Y N
33.	Improved Work Attendance:				Y N
34.	Increased Self-Esteem:				Y N

35. Contact Hours: __ __ __ __

STUDENT EVALUATION

Pre-Evaluation

Name:_____ **Date:**_____

Course:_____ **Instructor:**_____

GOALS	1 20%	2 40%	3 60%	4 80%	5 100%
I need to improve my communication skills.					
I need to improve my productivity.					
I need to improve my work attendance.					
I need to improve my self-esteem.					

List 4 goals related to the following that you want to improve in:

Communications:_____

_____

Reading:_____

_____

Writing:_____

_____

Math:_____

_____

Rate yourself on a scale of 1-5 as to where you are with these goals. 1 would be the lowest and 5 would be the highest.

EVALUATION

STUDENT DAILY LOG

NAME:

DATE:

CLASS:

1. What did you learn today? What did you find useful about the lesson? How was it interesting?

2. What did you find not necessarily useful, and what could have been done to improve the effectiveness of the lesson?

3. What other reactions do you have to the class, materials, discussion, etc.?

4. Are you comfortable with the material? Why or why not?

5. How have you used any of the information learned in previous classes?

WORKPLACE MATH I: Easing into Math

SESSION I

"Mental Handout"

Practice adding these mentally. Check with a traditional approach or calculator if you wish.

1. 16
   17
   18
   19
   ---

2. 34
   23
   11
   42
   ---

3. 65
   44
   25
   85
   ---

4. 71
   82
   93
   64
   ---

5. 68
   24
   86
   42
   ---

6. 123
   244
   361
   482
   ---

7. 55
   15
   ---

8. 41
   26
   17
   28
   18
   ---

9. 364
   196
   288
   472

WORKPLACE MATH I: Easing into Math
SESSION II

"I have never liked math and this course and this teacher changed the feeling I have about math."

Math I Student

Learning Intentions:

- Students will enjoy lots of examples of the mental number tricks from Session I. Choose ones from the Session II lesson and create others if students want them.

Curriculum Notes:

- Curriculum notes and references follow course outline.

Course Outline:

I. Math Assess/ Review Mental A.

II. Review Mental Handout.

1.	2.	3.	4.
16	14	123	146
19	22	142	238
17	36	181	312
18	48	164	424
---	---	---	---

III. Fraction intro. language. Creating statements by group instructor.

- Ex. A) 2 out of 4 have straight lines
  B) 1 out of 4 is circle
  C) 3 out of 4 are geometry shapes

- A) 3 out of 5 are letters
  B) 4 out of 5 have straight lines

IV. Partners: Using fraction blocks make some statements.

- Choose a group of 3-7 shapes. Create some statements.
- Change number of objects. Create statements.

V. Large Group: Review Statements.

VI. Fractions: Part of a group or part of a whole.

VII. Definitions for part of a whole.

red = 1 ? 1 red =1/2
blue = 1 ? 1 blue = 1/3
green = 1 ? 1 green = 1/6
can trade for one yellow

VIII. Write: use addition to show equality of 1. Discuss with table.

1/2 + 1/2 = 1 1/3 + 2/3 = 1 , etc.

IX. Addition: answers #1 can trade or put on top

A) 1/2 + 1/6 =
B) 1/3 + 1/6 =
or whole - 1/6 = 5/6
C) 2/3 + 1/2 =
D) 1/2 + 1/6 + 1/3 =
E) 4/6 + 1/3 =

1/2 = 3 greens
1/3 = 2 greens = 3/6 = 1 red = 1/2

discuss ways of doing this

X. Mixed Number Addition

- Add wholes together first okay? Fractions separate. Secondly ok. Convert. Simplify.

A) 1 1/2 + 1/3 =
B) 1 1/3 + 1 1/6 =
C) 1 5/6 + 2 1/3 =
D) 1 1/6 + 1 1/2 =
E) 1/2 + 1/3 + 5/6 =
F) 2/3 + 1 1/2 =
G) 4/3 + 5/6 =

XI. Summary: When you add fractions.

- Discussion. Could you give a few details?
  A) you define equalities. 1/3 = /6 1/2 = /6 1 = /2
  2/3 = /6
  B) you convert "trade" using the equalities
  C) you count how many there are.

XII. Evaluations

A. Daily Evaluations
Students record comments about the class and how they can use their new skills on the job.

WORKPLACE MATH I: Easing into Math
SESSION II

Review

Add left to right:

1.	2.	3.	4.	5.
11	18	16	12	54
22	26	17	13	15
33	14	18	14	20
44	12	19	11	11

6.	7.	8.	9.	10.
413	213	162	214	616
111	142	178	446	824
150	131	296	638	732
213	224	484	822	948

Add mentally.

11.

12		14
	13	
11		50

12.

16		19
	14	
27		24

13.

27		48
	19	
16		20

Curriculum Notes:

IV. Partners: Using Fraction Blocks

Fractions can be thought of in two ways and we often fail to point this out to students. A fraction can represent a part of a group or a part of a whole. The pizza cut into pieces with the question asking what 2 of the pieces represent is most commonly used and this is a statement about part of a whole. It is more advanced in difficulty but most people start with and remember this as the only concrete example of a fraction.

Creating statements about part of a group is a good way to start. Draw 4 or 5 shapes that have some similarities and differences. Give some examples of statements that could be made about members of this group. 2 out the 4 shapes have straight lines. 1 out of the 4 is a circle. 3 out of 4 are geometry shapes. Give a different list of shapes and ask people to discuss (with a partner, with small groups, or as a whole class) some statements that would describe members of this new group.

Use fraction notation to symbolize the ideas at the end of the communication exercise. 3 out of 5 have straight lines and be abbreviated as 3/5.

V. Large Group - Review Statements

One way to extend this and lead to work with fractions in the concrete sense is to use pattern blocks. These are blocks that are used to teach children about geometry, symmetry and fractions. The students could choose a group of these shapes and create statements similar to the ones the instructor created as a warm up to the next activity.

VI. Fractions

Fractions can also represent part of a whole. Some examples:

Money. The whole is the dollar, and the parts are the quarters, dimes and nickels. The fractions would be 25/100, 10/100 and 5/100. These mean 25 out of 100 cents, etc. and it's helpful to point this out. Another example might be the whole is the pizza and how much I get to eat are the shaded pieces. There are 8 slices in the pizza and I ate 3 would be written 3/8. Ratios are often examples of parts of a whole, and this application of fractions is used in the workplace more often. Students may be able to contribute workplace examples here, with the instructor translating the statements into mathematical symbolism.

How to use pattern blocks to teach fractions:

The choice of the whole is arbitrary, but the yellow hexagon offers the most possibilities.

VI. Fractions Continued

Equality will be defined as congruent in shape. The whole will be defined as the yellow hexagon. Extensions could change this definition. The blocks make concrete the step of changing to common denominator before adding or subtracting, with the idea of "swapping" equals.

Have students create a hexagonal shape using other blocks of same colors. Then define the fractions. 2 reds = 1 yellow, so 1 red = 1/2 yellow; 3 blue = 1 yellow, so 1 blue = 1/3 yellow; 6 green = 1 yellow, so 1 green = 1/6 yellow.

We could "swap" 3 blues for 1 yellow or 6 greens for 1 yellow.
(Likewise we do this with money: 4 quarters for a dollar, etc.)

VII. Definitions for Part of a Whole

Show equality to 1 yellow using addition and share with memebers of small group (or table of students). 1/2 + 1/2 = 1, 1/3 + 2/3 = 1, 2/3 + 2/6 = 1, 3/6 + 1/2 = 1.

VIII. Write: Use Addition to Show Equality of 1

Compute sums with answers not equal to 1. Trade in ways so that the final "answer" is composed of the same color.

Examples:

1/2 + 1/6 = 4/6

Swap 1/2 which is red for 3 greens or 3/6. Then count all of the greens (4), so the answer is 4/6. The instructor could wait to reduce this until later, but some students will contribute this anyway and this is okay.

1/3 + 1/6 = 3/6

Swap 1/3 for 2 greens or 2/6. Count the green ones: 3/6.

Emphasize that the colors have to be the same in order for the counting to have meaning. The mathematical terminology could be used here: The denominators have to be the same in order for the addition to have meaning. Don't actually show the math rule for awhile until the swap and count routine is comfortable.

2/3 + 1/2 = 7/6 or 1 1/6.

VIII. Write: Use Addition to Show Equality of 1 Continued:

Swap 2/3 for 4 greens and 1/2 for 3 greens. Count and there are 7 greens. 6 of these could be exchanged for a yellow. 7/6 = 1 1/6.

Lots of practice using denominators of 2,3,6.

IX. **Mixed Number Addition:**
Like when adding left to right, as long as the units that are the same get counted together, it is all right. It is not necessary to convert a mixed number to an improper fraction in order to add, but some people may wish to do this, which is also all right.
Examples:

1 1/3 + 1 1/6 = (1+1) + (1/3 + 1/6) = 2 + 3/6. Swap the 1/3 for 2 greens and then count. It is possible but not necessary to convert the wholes to greens also, then count all.

X. **Summary:**
What do you do when you add fractions?

Solicit student responses to the process with the pattern blocks.

A. Define equalities like 1/3 = 2/6 and 1/2 = 3/6.
B. Convert as needed by swapping, using the equalities until everything is in the same unit or color.
C. Count how many of that color there are. "Reduce" or trade back in if possible.

WORKPLACE MATH I: Easing into Math
SESSION III

"The course was hard enough to make us think".

Math I Student

Learning Intentions:

- Students will understand basic math operations and alternative strategies of doing them.

Curriculum Notes:

- Curriculum notes and references follow course outline.

Course Outline:

I. Review/ warm up

23	31	12	16	13	16	42
61	59	48	34	14	19	16
---	---	---	---	21	18	28
				12	27	34
				---	---	---

II. Assessment

III. "In terms of" Introduction

In terms of and addition

36 = 3(10) + 6
19 = 1(10) + 9
---
55 = 4(10) + 15

45 = 4(10) + 5
68 = 6(10) + 8
---
113 = 10(10) + 13

39 = 3(10) + 9
24 = 2(10) + 4
---
63 = 5(10) + 13

36 = 4(9)
19 = 2(9) + 1
---
55 = 6(9) + 1

36 = 3(12)
19 = 1(12) + 7
---
55 = 4(12) + 7

36 = 7(5) + 1
19 = 3(5) + 4
---
55 = 10(5) + 5

36 = 7(5) + 1
19 = 4(5) - 1
---
55 = 11(5)

III. "In terms of" Introduction Continued

- **Practice**

Do in terms of:

```
  42
+ 27
-----
```

Do in terms of your choice:

```
  42
+ 27
-----
```

Do 3 diff. ways in terms of:

```
A) 56      B) 39      C) 75      D) 45
+ 39       + 28       + 27       + 37
--------   --------   --------   --------
  95         67         102        82
```

IV. Subtraction: Way we're taught: Errors in language

```
 62
-19
----
 43
```

A good concept. Please explain what you mean.

V. Subtraction: What borrowing really was. What was it?

```
  62 = 6(10) + 2 = 5(10) + 12
- 19 = 1(10) + 9 = 1(10) + 9
---------         ------------
  43 =            =4(10) + 3
```

```
  43 = 4(10) + 3 = 3(10) + 13
- 18 = 1(10) + 8 = 1(10) + 8
-------           ------------
  25                2(10) + 5
```

```
  97 = 9(10) + 7 = 8(10) + 17
- 29 = 2(10) + 9 = 2(10) + 9
-------           ------------
  68                6(10) + 8
```

VI. Subtraction in terms of: Without borrowing:

```
  29 = 5(5) + 4   or        29 = 4(6) + 5
- 16 = 5(5) + 1   or      - 16 = 2(6) + 4
-----------------          -------------
    13                        2(6) + 1
```

VII. With "Borrowing":

$$\begin{array}{l} 43 = 7(6) + 1 \\ -\ 18 = 3(6) \\ \hline 68 = 9(8) - 4 \end{array} \qquad \begin{array}{l} 97 = 12(8) + 1 \\ -\ 29 = 3(8) + 5 \\ \hline \end{array}$$

VIII. Short cut subtraction left to right:

41	72	38	74	32
- 26	- 38	- 19	- 58	- 29
20-5	40-6	20-1	20-4	10-7

IX. Review addition with blocks if time.

A) 1/6 + 1/3 =

B) 1/2 + 1/6 =

C) 2/3 + 1/2 =

D) 1 2/3 + 1 1/6 =

E) 1 5/6 + 1/3 =

G) 2 2/3 + 5/6 =

H) 1 1/2 + 1/3 =

I) 1/2 + 1/6 + 1/3 =

X. In terms of addition:

1/6 + 1/3 do in terms of 1/6. Why? Because you can convert 1/3 = 2/6. You can't convert 1/6 = ?/3 with blocks.

1/2 + 1/6 = do in terms of 1/6 Rename fractions then count like amounts.
2/3 + 1/2 = do in terms of 1/6
1 5/6 + 1/3 = do in terms of 1/6

XI. Homework. Do in terms of 3 ways: Make up in class.

XII. Evaluation

A. Daily Journal

Students record comments about the class and how they use their new skills on the job.

Curriculum Notes:

I. **Review**
Do mental addition. Put problems on board or overhead for students to practice.

II. **Pre test**

III. **"In terms of" Introduction**

Writing numbers "in terms of" others is helpful for three reasons: 1. Students work again with place value, using different bases, 2. Students get very used to adding like terms or numbers of the same basic value, and 3. The idea can transfer the knowledge into subtraction with "borrowing", fraction algorithms, and algebra.

Introduction: People are often known or introduced to others "in terms of" their relationships with someone else. A person may be known to her child's friends as Johnny's mom, as her husband's wife at a party, and by a nickname to her mother. She is the same person known by different names based on these relationships. Likewise numbers get known and written in terms of others, a very powerful mathematical concept.

Using "in terms of" to write numbers, then in addition of those numbers:

36 in terms of 10: 3(10) + 6
19 in terms of 10: 1(10) +9
---
55 in terms of 10: 4(10) +15 or 5(10) + 5

(Add the tens together and the remainders together.)

Same problem in terms of 8:

36 in terms of 8 = 4(8) + 4
19 in terms of 8 = 2(8) + 3
---
55 in terms of 8 = 6(8) + 7
(Add the 8's together and the remainders together.)

IV. **Subtraction with borrowing**
The way we're taught traditionally is incorrect. It contains errors in language, primarily in how we refer to digits within numbers, rather than using the place value of the digit. Most people experience problems with this part of their math education and some never get beyond this problem.

IV. **Subtraction with borrowing** Continued

Example:

```
  62
 -19
```

Ask someone to volunteer to explain. Here is what they would probably say. Borrow from the 6 and make it 5. Put a 1 by the 2 and make it 12. 12 - 9 = 3 and 5 - 1 = 4. The answer is 43. This is the rote memorization of the subtraction process and the explanation doesn't contain any conceptualization. Here is a similar explanation that corrects the errors in language and inserts the concepts:

Take a 10 from the 6 tens and now you have 5 tens. Swap the 10 you took for 10 ones and add them to the 2 you have, so now there are 12 ones. 12 ones subtract 9 ones are 3 ones. 5 tens subtract 1 ten is 4 tens. 4 tens is worth 40 + 3 ones = 43.

People have trouble with subtraction because it is difficult to make sense out of the traditional explanations. Adults do have a lot of experience with money, however, and spending is subtraction. This can be capitalized on.

V. **Subtraction. Borrowing is really rewriting numbers in terms of others.**

```
  62 = 6(10) + 2 = 5(10) + 1(10) + 2 = 5(10) + 12
  19 = 1(10) + 9
  62 = 5(10) + 12
- 19 = 1(10) + 9
-------------------------
  43 = 4(10) + 3
```

Be sure to subtract both the 10's column and the one's column.

Other examples:

```
  43 = 4(10) + 3 = 3(10) + 1(10) + 3 = 3(10) + 13
- 18 = 1(10) + 8
```

```
  43 = 3(10) + 13
- 18 = 1(10) + 8
-----------------------
  25 = 2(10) + 5
```

```
  97 = 9(10) + 7 = 8(10) + 1(10) + 7 = 8(10) + 17
- 29 = 2(10) + 9
```

V. **Subtraction. Borrowing is really rewriting numbers in terms of others.**

$$\begin{array}{r} 97 = 8(10) + 17 \\ -\ 29 = 2(10) + 9 \\ \hline 68 = 6(10) + 8 \end{array}$$

VI. **Examples for subtraction in terms of different numbers than 10**

In terms of 5:

$$\begin{array}{r} 29 = 5(5) + 4 \\ -\ 16 = 3(5) + 1 \\ \hline 13 = \ ,5) + 3 \end{array}$$

In terms of 6:

$$\begin{array}{r} 29 = 4(6) + 5 \\ -\ 16 = 2(6) + 4 \\ \hline 13 = 2(6) + 1 \end{array}$$

VII. **With "Borrowing"**

VIII. **Alternative method for subtraction from left to right.**
This is based on integers, getting negative numbers for answers when the first number is smaller than the second.

$$\begin{array}{r} 41 \\ -\ 26 \end{array}$$

40 - 20 = 20.
1 - 6 = -5
The answer is 20 - 5 = 15.

$$\begin{array}{r} 72 \\ -38 \\ \hline 40 - 6 = 34 \end{array} \qquad \begin{array}{r} 38 \\ -19 \\ \hline 20 - 1 = 19 \end{array} \qquad \begin{array}{r} 74 \\ -\ 58 \\ \hline 20 - 4 = 16 \end{array}$$

WORKPLACE MATH I: Easing into Math
SESSION IV

"The teaching style of the instructor and content of the class has made it easier to learn and made me want to learn more".

Math I Student

Learning Intentions:

- Review of mental arithmetic, "in terms of", how to develop an algorithm, and fraction blocks and addition. Addition of unlike fractions and mixed numbers without blocks.

Curriculum Notes:

- Curriculum notes and references follow course outline.

Course Outline:

I. Warm up: do in terms of (?) two ways

```
   42          57
+  16       +  35
--------    --------
```

II. Three Problems. Homework do in terms of 3 ways

III. Assessment - Review

- Reassurance

IV. Creating an Algorithm

- #25 - 34 how many are there?

A) Make a simpler version of a problem

# 1 - 5 how many?	1 2 3 4 5	1) show how to count
# 2 - 6 how many?	2 3 4 5 6	2) rule
# 35 - 94 how many?		

B) Explanation of subtraction gives the difference, not counting the starting #. To count starting number, add 1.
Practice - give some left to right subtraction practice.

V. Shortcut Review

24	67	38	74
- 19	- 29	- 29	- 25
------	------	------	------

VI. Review Addition with Blocks Fractions

A) 1/6 + 1/3 = B) 1/2 + 1/3 = C) 1/2 + 1/3 + 1/6 =

D) 1 2/3 + 1 1/6 = E) 2 2/3 + 5/6 =

Do in terms of:

A) Parallel these problems:

1/6 + 1/3 A) in terms of 32 = 4(8)

B) count + 14 = 1 (8) +6

1/6 = 1/6 ----------

1/3 = 2/6 = 5(8) + 6

B) 1/2 + 1/3 = C) 2/3 + 1/2 =

1/2 = 3/6 4/6 + 3/6 = 7/6 = 6/6 + 1/6 = 1 1/6

1/3 = 2/6

---------- D) 1/2 + 1/3 + 1/6

5/6

* To add, first get in terms of same thing, second, add like amounts.

A) Parallel: add really is:

25 = 2(10) + 5

+14 = 1(10) + 4

----

39 = 3(10) + 9

VII. Do in terms of 3 different ways: Rename as 3 different

VIII. Choosing a Common Denominator

A) 1/4 = B) 2/3 = C) 1/2 = D) 5/8 =

1/4 + 1/2 = do in terms of 1/4: A) in terms of

A) 1/4 + 2/4 = B) count - stress add = count

B) 3/4 + 1/2 =

C) 1 1/2 + 3/4 =

IX. Do same problems without blocks

A) 1/3 + 1/2 =
1/3 = /6
1/2 = /6
B) 1/2 + 1/4 =
1/2 = /4
1/4 = /4
C) 2/3 + 1/6

D) 1/12 + 1/2
E) 1/10 + 2/5
F) 1/2 + 3/5

H) 1 1/3 + 2 1/4 =
I) 3 1/2 + 2 1/4 =

A) choose an in terms of - discuss: ways to get 6. (multiple of 2 and 3)
B) convert. discuss how. Show with blocks. Ok to draw for yourself for now. Algorithm.
C) count the 6ths. Re-convert if necessary.

A) Do w/o blocks. Draw is ok.
B) Convert. Count.
C) Check with blocks.

G) mixed numbers. a) fractions b)wholes c)rename

1) 1 1/3 + 2 1/2 w/o blocks with blocks
2) 2 1/2 + 1 1/6 =
3) 1 2/3 + 1 1/2 =

X. Homework: Drawings ok

A) 1 1/3 + 2 1/2 = B) 3/4 + 5/8 = C) 3/7 + 2/3 =

Curriculum Notes:

IV. Creating an algorithm

This is an example of a work place application when employees brought a problem of having to count boxes numbered sequentially but not beginning with the number 1. How many are there? It helps to make a simpler version of the problem. We can draw 5 objects and number them sequentially starting with 1 or starting with any other number. We could count them or we could subtract their object number and then add one.

V. Review some "in terms of" addition problems

Give a few in terms of 10 and in terms of other numbers. Perhaps the students could choose. It is interesting to give one problem and then have students do this same problem in terms of 3 different numbers; in other words, have them work the problem three different ways. They should come out a with a true statement all three times.

VI. Review Addition with Fraction Blocks

Have them review with fraction blocks some addition problems with denominators of 2, 3, and 6. Use only addition but review both fractions and mixed numbers. More than two numbers to add would be all right. Review the rules generated in Session 3:

Define equalities. Swap as necessary so that the problem is expressed in the same colors and then count the number of that color. Reduce or "cash in" as necessary.

Make a parallel between counting like colors and combining like terms as in the "in terms of" work: 10's get added to 10's. 8's get added to other 8's. Remainders are added to remainders.

VII. Doing "in terms of" when applied to common denominators

Build the transfer blocks to writing.

Define equalities.

Develop the traditional algorithm, emphasizing that the original fraction is being multiplied by the equivalent of 1. Multiplying by 1 doesn't change the value, only the appearance of a quantity.

$1 = 3/3.\quad 1 = 2/2.\quad 1 = 100/100.\quad 1 = 5/5.$

$1/2 \times 3/3 = 3/6$ so $1/2 = 3/6$

VII. Doing "in terms of" when applied to common denominators

1/2 x 2/2 = 2/4 so 1/2 = 2/4

Do lots of these.

Likewise dividing by 1 doesn't change the value, only the appearance of a quantity. This is the step used to "reduce" or cash in a quantity.

3/12 divided by 3/3 = 1/4
2/4 divided by 2/2 = 1/2

VIII. Choosing a Common Denominator

Use 2, 3, 6 at first. 1/2 + 1/3 = Show with blocks. What is the common denominator? To choose numerically, get the least common multiple. Define this for the students. It is a number both (or all) of the denominators go into evenly. 2 and 3 go into 6, so 6 is a good one. 2 and 3 also go into 12, so 12 would work, but there would be a bit more reducing at the end. Show them all the possibilities. Math is so often reduced to only one method and this is one thing that frightens people. The need to see that of all these denominators, they all work and the smallest may have the added advantage of creating less work, but that is often the only advantage. Do several problems where students only choose the common denominator.

IX. Do Same Problems Without Blocks

Now it is time to do the whole process without blocks, but the first problem is one that can be done at the same time using them so the transfer can be created. It may be helpful to model each step. Use simple fractions at first. Save mixed numbers until later.

1/3 + 1/2 =

A. Choose an "in terms of". Discuss the ways to get 6 numerically.

B. Convert. Show with blocks. Show likewise in written form with each fraction. Choosing the best form of 1 is important now. How is it done? 1/3 = ?/6. What can 3 be multiplied by to get 6? 2/2 then is your best form of 1, since 3x2 = 6. 1/2 = ?/6. What can 2 be multiplied by to get 6? 3/3 is the best form of 1 to use to convert this fraction since 2x3 = 6.

C. Count the 6ths. They are the same type, so the counting has meaning.

Practice these fractions until student seem confident and comfortable.

X. **Homework**

Now it is time to use mixed numbers. Try some at first that can be modeled with blocks. Some will remember the process of making improper fractions of the mixed numbers and this method is still ok. Show how to do this when it comes up, but explain that it is a shortcut for converting all of the 1's to 6ths or 4ths or whatever the common denominator is. Also show that the wholes can be added together and the fractions can be added together separately, perhaps doing the same problem both ways so people can see that the answers are the same.

Give some to try in class and allow students to explain what it is they are doing. Another exercise would be for them to journal about the process and their understanding of it. Do they have any new understanding and if so, what? What is still difficult?

WORKPLACE MATH I: Easing into Math
SESSION V

"I feel very comfortable adding, subtracting, multiplying and dividing especially using fractions, after taking this course".

Math I Student

Learning Intentions:

- Review mental arithmetic, "in terms of", addition of fractions with and without pattern blocks.
- Subtraction of fractions with and without blocks including mixed numbers and borrowing.

Curriculum Notes:

- Curriculum notes and references follow course outline.

Course Outline:

I. Mental Math

42	67	114	684
34	88	123	893
16	49	132	472
+ 28	+ 26	+ 141	+ 261
-------	---------	----------	----------

II. #34 - 52 How many?

III. Review, Go over fractions in terms of

A) 26 in terms of 3 diff. ways
+49

B) 4/3 = in terms of same thing
+1/6 =

III. Review, Go over fractions in terms of Continued

Blocks A) 1/6 + 1/3 B) 1/2 + 2/3 C) 5/6 + ?

Written
C) Have problems go over. Also try: A) 3/4 + 1/2 = 2/3 + 5/6 =
1 1/4 + 2 7/8 =

IV. Fraction Subtracting with Blocks

A) 5/6 - 1/6 = 4/6 trade 2/3 (defined as removing blocks from spaces)

B) 2/3 - 1/2 = Practice by trading/ then removing same color

C) 5/6 - 1/3 =

D) 1 1/2 - 1/3 =

V. With Borrowing

E) 1 1/3 - 5/6 = F) 2 1/2 - 2/3 = G) 2 - 1/6 = H) 3 - 2/3 =
(like getting change)

I) 1 1/3 - 1/2 = J) 1 1/2 - 5/6 = K) 1 1/3 - 2/3 = L) 3 1/3 - 1 1/2 =

M) 2 1/2 - 1 2/3 = N) 3 2/3 - 1 5/6 = O) 1 1/3 - 1/2

Patterns:

1) get in terms of same color
2) remove
3) regroup

VI. Theory Without Blocks

A) 5/8 - 1/8 = B) 2/3 - 1/3 = C) 3/4 - 2/4 =

D) 5/8 - 1/2 = E) 2/3 - 5/8 = F) 3/4 - 2/3 =

VI. Theory Without Blocks

Borrowing: G) 1 - 1/3 H) 2 1/2 - 1/3 = I) 1 1/6 - 1/2

J) 3 1/3 - 5/8 = K) 3 1/4 - 1 1/3 = L) 4 1/2 - 1/34 =

Decimals if time: A) 1.167 + 2.34 + 0.8 = B) 21.4 - 0.987 =

Handout if time.

WORKPLACE MATH I: Easing Into Math
SESSION V

Fractions Handout

1) 1/2 + 2/3 =

2) 3/4 + 1/2 =

3) 1 2/3 - 5/6 =

4) 1 5/6 + 2 1/3 =

5) 3/6 - 1/3 =

6) 1/2 + 1/3 + 1/6 =

7) 1/2 + 5/6 =

8) 3 1/2 - 1 1/6 =

9) 2 1/3 + 1 5/6 =

10) 1 1/2 - 1/3 =

Curriculum Notes:

IV. Subtraction with blocks

This is similar to addition except that instead of placing additional blocks to signify the addend, the quantity is removed from the desk. Before removing, convert the first number to a color that will work with the second. (Find a common denominator.) Allow the students some time to practice this, but if they are comfortable with the blocks, it won't take long.

V. Subtraction with Borrowing

Swapping the unit block for 6ths or 3rds and leaving the fraction in the first number alone until later is one method. Follow it up with writing after the students can do a problem independently.

A second method involves converting a part or all of the first number, combining it with the fraction part and then subtracting.

Depending on the problem one method may be more efficient but both will give the same result. It is ok for a student to prefer to do all of the problems using the same method.

VI. Theory Without Blocks

Develop the written algorithm and drawing connections between the addition and subtraction methodology. The steps are the same as for addition: Choose a common denominator, convert the fractions and subtract. When borrowing show both methods as written in the section 6 notes and allow students a choice. Reinforce with pattern blocks as needed. Some classes or students may need the blocks to support the symbolism for awhile. Some may find them in the way.

WORKPLACE MATH I: Easing Into Math
SESSION VI

"This course has helped me solve problems with more accuracy".
Math I Student

Learning Intentions:

- Mental multiplication and division, review of previous material, post test.

Curriculum Notes:

- Curriculum notes and references follow course outline.

Course Outline:

I. Review Mental

12	26	12	14	37	11
24	39	14	+ 26	+ 43	58
38	47	16	------	------	+ 22
+ 46	+ 18	+ 18			------
------	------	------			

II. A. Mental Multiplication

13	16	12	14	17	19	16
x4	x5	x7	x5	x3	x4	x6

B.

12	14	15	16	19	17	15	22	23
x18	x16	x15	x13	x11	x13	x14	x11	x12

III. Fractions: Blocks/Writing

1/3 + 1/2 =	1/6 + 2/3 =	1 1/6 + 1/3 =	2 1/3 - 1 1/6 =
3 1/6 - 1 1/3 =	3 1/2 - 1 1/4 =	4 1/2 - 1 3/4	5/8 + 1/10 =
3 1/6 - 2 1/2 =			

IV. Division

1) 42/4 = 40/4 + 2/4 = 10 1/2
2) 39/6 = 36/6 + 3/6 = 6 1/2
3) 48/7 = 49/7 - 1/7 = 7 1/7 = 6 6/7
4) 58/10 = 50/10 + 8/10 = 5 8/10 = 5 4/5
5) 12/4 = 8/8 + 4/8 = 1 1/2
6) 134/5 = 150/5 - 16/5 = 150/5 - 15/5 - 1/5 = 30 - 3 - 1/5 = 27 1/5 = 26 4/5

Try to do 2 different ways.

7) 32/9 =
8) 48/5 =
9) 168/7 =

V. If you had #16-49 how many is this?

VI. Review handout

VII. Post Test

VIII. Evaluations

A. Daily Journal
Students record comments about the class and how they can use their new skills on the job.

IV. Administrative Details

A. Post-evaluation
B. Course Evaluation
C. Instructor Evaluation
D. Certificates

WORKPLACE MATH I: Easing Into Math
SESSION VI

Review

Add mentally, making notes when necessary:

1.	2.	3.	4.	5.
23	18	416	123	611
41	16	127	233	822
12	12	118	341	911
+ 30	12	+ 119	+ 412	+ 722
-------	+ 12	---------	---------	---------

Subtract the "new" way mentally from left to right. Check if you wish using the "old" way.

6. 63 - 51 = 7. 49 - 27 = 8. 44 - 19 = 9. 37 - 29 =

10. 76 - 39 = 11. 35 - 27 = 12. 52 - 18 = 13. 41 - 29 =

Add or subtract making conversions as needed:

14. 2/3 + 1/6 = 15. 1/2 - 1/6 = 16. 1 - 1/6 = 17. 3 1/3 + 1 1/2

18. 2 - 5/6 = 19. 2 1/4 + 1 1/2 = 20. 1 1/5 + 3/10 =

Curriculum Notes:

II. Mental Multiplication

A.

Multiplication can be done easily from left to right if place value is emphasized. Start with a two digit number between 10 and 20 multiplied by a one digit number. Show first in vertical form. This can be followed using horizontal form which would nicely lead to the distributive law and an algebra example.

13
x4

$(10x4) + (3x4) = 40 + 12 = 52$

$4(13) = 4(10+3) = 4(10) + 4(3) = 40 + 12 = 52$
let $x = 10$
$4(x+3) = 4x + 12$

The horizontal method can be tied to "in terms of" by renaming the two digit number without using 10.

$$4(13) = 4(8+5) = 4(8) + 4(5) = 32 + 20 = 52$$

B.

The method works well for 2 digit numbers multiplied together. The mental application is best when the 2 digit numbers are between 10 and 20.

IV. Division

It is interesting to play with division because it can be connected to fraction work smoothly and provides an alternative for those people who have skill problems with division.

The idea is to write the numerator as a sum or a difference. One of the numbers in the sum is a multiple of the denominator. The other is a remainder. It may or may not be less than the denominator. Write the sum than as 2 fractions, each having the same denominator. Then reduce the fractions. Give students several to practice, showing both sums and differences.

VI. Review

Some review is helpful before the students take the post test.

WORKPLACE MATH I: Easing into Math

SESSION VI

Post Test

Name:_____

Add or subtract mentally:

1. 26 + 17 + 48 + 32 = ---
2. 36 + 27 + 18 + 49 = ---
3. 42 + 14 + 38 + 26 = ---
4. 111 + 222 + 343 + 434 = ---

5. 36 + 28 + 17 + 19 =
6. 48 - 15
7. 92 - 74
8. 73 - 35

Multiply mentally:

9. 17 x 5
10. 14 x 7
11. 19 x 11
12. 13 x 17

13. If you had some items numbered in sequence starting with #17 and ending with #78, how many items is this?

Add or subtract:

14. 5/6 + 1/2 =
15. 2 3/5 - 1 1/10 =
16. 2 1/8 - 1 1/4 =

17. 3 1/2 - 1 1/4 =
18. 1/3 + 1/2 =
19. 5/6 - 1/3 =

20. 4 1/2 - 2 7/8 =

REFERENCES

Getting It Together, Math Problems for Grades 4 Through 12. Berkeley: EQUALS at Lawrence Hall of Science, University of California.

Burns and McLaughlin. *A Collection of Math Lessons for Grades 6 Through 8.* Math Solutions Publications, 1990.

STUDENT EVALUATION

Post-Evaluation

Name: _____ **Date:** _____

Course: _____ **Instructor:** _____

GOALS	1 20%	2 40%	3 60%	4 80%	5 100%
I improved my goal in communication.					
I improved my goal in productivity.					
I improved my goal to increase my work attendance.					
I improved my goal to increase my self-esteem.					

WORKPLACE LEARNING PROGRAM
INSTRUCTOR EVALUATION
CURRENT AND PIKES PEAK COMMUNITY COLLEGE

Please check one response to each question.	Excellent	Very Good	Satisfactory	Needs Improvement	Poor
1. The instructor is organized in his/her teaching of this class.					
2. The instructor projects warmth, friendliness and enthusiasm in his/her presentation.					
3. The instructor returns tests and assignments within one class session.					
4. The instructor encourages student participation in class.					
5. The instructor reacts in a positive manner to students' questions and responses.					
6. The instructor is willing to give individual help when you request it.					
7. The instructor clearly communicates how the course is related to your learning needs.					
8. The instructor is skilled and knowledgeable in the material.					
9. You feel comfortable with asking your instructor to teach what you feel is important to your learning needs.					
10. By reviewing your portfolio, you are familiar with the changes in your own learning.					

What comments do you have that will help in the design of future courses?_____

_____

_____

_____

_____

WORKPLACE LEARNING PROGRAM
PARTICIPANT EVALUATION
CURRENT AND PIKES PEAK COMMUNITY COLLEGE

Please answer the questions which follow. Your responses will help us in making improvements in the course.

1. How would you rate the content of this course?

Too Difficult		Just Right		Too Easy
5	4	3	2	1

2. How would you rate the quality of the instruction materials?

Very Interesting		Somewhat Interesting		Uninteresting
5	4	3	2	1

3. How useful was the course in helping you on the job?

Very Useful		Somewhat Useful		Not Useful
5	4	3	2	1

4. Overall, how satisfied were you with the course?

Very Satisfied		Somewhat Satisfied		Very Dissatisfied
5	4	3	2	1

5. What did you like the best about this course?_____
_____
_____
_____

6. What could have been done to improve the effectiveness of the course?_____
_____
_____
_____

7. How would you rate the quality of the instructional materials?
_____
_____
_____

8. Would you like additional time spent on this subject? Yes_____
No_____ If yes, what specific subjects?_____
_____
_____

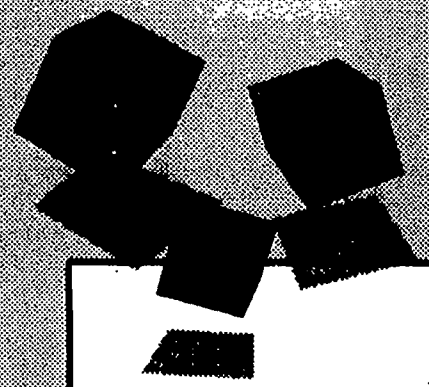
9. In what specific ways has this course helped you to do your job better?_____
_____
_____

10. How has this course helped meet goals you set before taking it?

11. Would you recommend this course to a co-worker? Yes_____No_____
Why or Why not?_____

12. Do you feel more confident about your learning abilities because of this class?_____

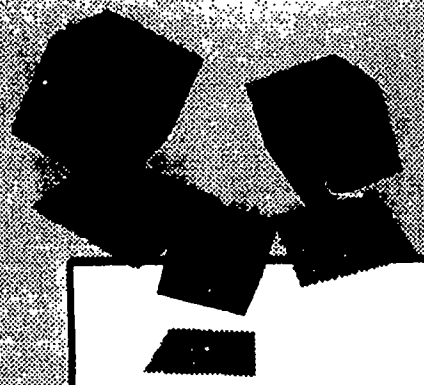
13. Will what you learned in class make a positive, noticeable difference in your outside interests?_____



SUPPLEMENTARY MATERIALS

The following is a more traditional approach to teaching Workplace Math I

Author: Claire Goschen



SUPPLEMENTARY MATERIALS

The following is a more traditional approach to teaching Workplace Math I

Author: Claire Goschen

MATHEMATICS OUTLINE

WHOLE NUMBERS:
- Number System
- Rounding
- Addition and Subtraction Whole Numbers
- Multiplication and Division Whole Numbers
- Average or Mean
- Order of Operations

FRACTIONS:
- Understanding Fractions
- Reducing Fractions
- Building Fractions
- Comparing Fractions
- Adding and Subtracting Fractions
- Multiplying and Dividing Fraction

DECIMALS:
- Decimal Notation
- Adding and Subtracting Decimals
- Multiplying and Dividing Decimals
- Multiplying or Dividing by Powers of 10

PERCENTAGES:
- Understanding Percents
- Conversion Between Fractions, Decimals, and Percents
- Solving Percent Problems (Given the Base and the Rate)
- Solving Percent Problems (Given the Base and the Part)
- Solving Percent Problems (Given the Rate and the Part)
- Finding the Percent Increase or Decrease

PROPORTIONS:
- The Concept of Proportions
- Solving Rate Problems
- Application of Proportions

MEASUREMENTS:
- American Units and Conversion
- Metric Units and Conversion

SELECTED TOPICS:
- Solving Word or Applied Problems
- Understanding Charts and Graphs
- What is Algebra and do I need it?

MATH I – SYLLABUS

Course Description: Basic math operations involving whole numbers, fractions, and decimals.
Attendance: Attending four of the six classes is required to receive certificate.
Assessments: Assessments are for monitoring progress. Grades are not recorded.

WEEK ONE

I. Pre-Assessment

II. Whole Numbers

A. Place Value -- Base 10 System (Handout #1)
B. Order of Operations (Handout # 2)
C. Operations:
    1. Addition (Handout #3)
    2. Subtraction (Handout #4)
    3. Multiplication (Handout #5)
    4. Division (Handout #6)

WEEKS TWO & THREE

III. Fractions

A. Reducing Fractions (Handout #7)
B. Raising Fractions (Handout #8)
C. Changing Improper & Mixed Fractions (Handout #9)
D. Operations:
    1. Addition (Handout #10)
    2. Subtraction (Handout #11)
    3. Multiplication (Handout #12)
    4. Division (Handout #13)

WEEK FOUR

IV. Decimals

A. Place Value -- Base 10 System (Handout #14)
B. Operations:
    1. Addition (Handout #15)
    2. Subtraction (Handout #16)
    3. Multiplication (Handout #17)
    4. Division (Handout #18)

WEEK FIVE

V. Review

WEEK SIX

VI. Last Questions

VII. Post-Assessment

VIII. Certificates

Math I – Pre-Assessment **Name:**_____ **Date:**_____

1. 3/4 + 2/3 =

2. 2/3 - 3/5 =

3. 3 3/4 ÷ 2 4/5 =

4. 4 1/3 - 2 1/2 =

5. 8/9 x 3/16 =

6. 5/8 ÷ 3/4 =

7. 57.3 ÷ .009 =

8. 161.015 - .61 =

9. 14.2 x .75 =

10. 112.5 ÷ 4.5 =

Math I – KEY

1. 3/4 + 2/3 = 17/12 = 1 5/12

2. 2/3 - 3/5 = 1/15

3. 3 3/4 + 2 4/5 = 5 31/20 = 6 11/20

4. 4 1/3 - 2 1/2 = 1 5/6

5. 8/9 x 3/16 = 1/6

6. 5/8 ÷ 3/4 = 5/6

7. 57.3 + .009 = 57.309

8. 161.015 - .61 = 160.405

9. 14.2 x .75 = 10.650

10. 112.5 ÷ 4.5 = 25

Whole Numbers -- Place Value -- Base 10 System **Handout #1**

Write the place value of each underlined digit:

1. 9,650

2. 972

3. 28,730

4. 826,110

5. 40,059

6. 926, 420

7. 2,106,920

8. 7,535,000

9. 57,425

10. 9,853,483

Solutions: **1.** 5 x 10 **2.** 2 x 1 **3.** 8 x 1,000 **4.** 1 x 100 **5.** 4 x 10,000 **6.** 9 x 100,000 **7.** 6 x 1,000 **8.** 7 x 1,000,000 **9.** 4 x 100 **10.** 8 x 100,000

Whole Numbers -- Order of Operations **Handout #2**

1. $2 \times 4 - 3 + 1 =$

2. $(4 + 3) \times 5 =$

3. $7 + 8 - 9 \div 3 + 4 =$

4. $8 + 6 \times (12 \div 6) =$

5. $4 \times 3 - 1 + 6 \div 3 =$

6. $9 \div (4 - 1) + 8 =$

7. $6 \times 3 + 2 - 10 \div 2 =$

8. $(8 + 4) \div 3 + 1 =$

9. $35 \div 7 + 4 \times 2 - 3 =$

10. $3 \times (9 - 5) \div 6 \times 2 =$

Solutions: **1.** 6 **2.** 35 **3.** 16 **4.** 20 **5.** 13 **6.** 11 **7.** 15 **8.** 5 **9.** 10 **10.** 4

Whole Numbers -- Addition **Handout #3**

1. 254 + 325 =

2. 476 + 18 =

3. 387 + 264 =

4. 473 + 182 =

5. 148 + 327 + 232 =

6. 135 + 456 + 784 =

7. 542 + 125 + 68 =

8. 817 + 76 + 453 =

9. 38 + 157 =

10. 450 + 326 - 188 =

Solutions: **1.** 579 **2.** 494 **3.** 651 **4.** 655 **5.** 707 **6.** 1,375 **7.** 735 **8.** 1,346 **9.** 195 **10.** 964

Whole Numbers -- Subtraction **Handout #4**

1. 48 - 25 =

2. 957 - 304 =

3. 899 - 425 =

4. 53 - 28 =

5. 329 - 150 =

6. 500 - 167 =

7. 906 - 29 =

8. 520 - 482 =

9. 700 - 543 =

10. 684 - 486 =

Solutions: **1.** 23 **2.** 653 **3.** 474 **4.** 25 **5.** 179 **6.** 333 **7.** 877 **8.** 38 **9.** 157 **10.** 198

Whole Numbers – Multiplication **Handout #5**

1. 234 x 2 =

2. 73 x 18 =

3. 83 x 24 =

4. 259 x 47 =

5. 64 x 300 =

6. 837 x 402 =

7. 126 x 280 =

8. 48 x 40 =

9. 527 x 63 =

10. 936 x 508 =

Solutions: **1.** 468 **2.** 1,314 **3.** 1,992 **4.** 12,173 **5.** 19,200 **6.** 336,474 **7.** 35,280 **8.** 1,920 **9.** 33,201 **10.** 475,488

Whole Numbers -- Division **Handout #6**

1. $432 \div 8 =$

2. $1505 \div 7 =$

3. $5416 \div 6 =$

4. $475 \div 28 =$

5. $1650 \div 5 =$

6. $9714 \div 42 =$

7. $7354 \div 36 =$

8. $1208 \div 4 =$

9. $348 \div 6 =$

10. $2477 \div 12 =$

Solutions: **1.** 54 **2.** 215 **3.** 902 r4 **4.** 16 r27 **5.** 330 **6.** 231 r12 **7.** 204 r10 **8.** 302 **9.** 58 **10.** 206 r5

Fractions -- Reducing **Handout #7**

1. 3/6 =

2.. 8/12 =

3. 4/10 =

4. 6/8 =

5. 20/25 =

6. 12/36 =

7. 6/9 =

8. 8/16 =

9. 16/20 =

10. 10/14 =

Solutions: **1.** 1/2 **2.** 2/3 **3.** 2/5 **4.** 3/4 **5.** 4/5 **6.** 1/3 **7.** 2/3 **8.** 1/2 **9.** 4/5 **10.** 5/7

Fractions – Raising **Handout #8**

1. 3/4 = ?/8

2. 2/3 = ?/12

3. 1/6 = ?/18

4. 7/10 = ?/20

5. 5/8 = ?/24

6. 2/5 = ?/30

7. 4/9 = ?/18

8. 1/4 = ?/12

9. 7/8 = ?/32

10. 3/5 = ?/25

Solutions: **1.** 6 **2.** 8 **3.** 3 **4.** 14 **5.** 15 **6.** 12 7. 8 **8.** 3 **9.** 28 **10.** 15

Fractions -- Changing Improper & Mixed **Handout #9**

Change each improper fraction to a mixed number:

1. 7/4 =

2. 14/5 =

3. 10/3 =

4. 15/8 =

5. 11/6 =

Change each mixed number to an improper fraction:

6. 1 5/6 =

7. 2 1/2 =

8. 3 4/5 =

9. 10 3/4 =

10. 1 3/4 =

Solutions: **1.** 1 3/4 **2.** 2 4/5 **3.** 3 1/3 **4.** 1 7/8 **5.** 1 5/6 **6.** 11/6 **7.** 5/2 **8.** 19/5 **9.** 43/4 **10.** 7/4

Fractions – Addition **Handout #10**

1. 2/9 + 5/9 =

2. 7/10 + 9/10 =

3. 1/4 + 3/5 =

4. 5/6 + 2/3 =

5. 2 1/5 + 3 2/5 =

6. 4 5/12 + 2 7/12 =

7. 1 1/4 + 3 2/3 =

8. 5 2/3 + 2 2/5 =

9. 6 5/8 + 1/6 =

10. 3 2/3 + 2 3/4 =

Solutions: **1.** 7/9 **2.** 1 3/5 **3.** 17/20 **4.** 1 1/2 **5.** 5 3/5 **6.** 7 **7.** 4 11/12 **8.** 8 1/15 **9.** 6 19/24 **10.** 6 5/12

Fractions – Subtraction **Handout #11**

1. 11/12 - 5/12 =

2. 5/6 - 3/8 =

3. 9/16 - 1/4 =

4. 6 - 2 3/5 =

5. 4 7/8 - 1 3/8 =

6. 7 3/4 - 2 2/3 =

7. 8 - 5 2/9 =

8. 6 1/6 - 3 5/6 =

9. 9 1/4 - 8 5/8 =

10. 7 2/5 - 1 2/3 =

Solutions: **1.** 1/2 **2.** 11/24 **3.** 5/16 **4.** 3 2/5 **5.** 3 1/2 **6.** 5 1/12 **7.** 2 7/9 **8.** 2 1/3 **9.** 5/8 **10.** 5 11/15

Fractions – Multiplication **Handout #12**

1. 2/3 x 1/5 =

2. 5/6 x 5/8 =

3. 3 x 4/5 =

4. 3/7 x 2/9 =

5. 3/8 x 6 =

6. 5 x 2 3/10 =

7. 5/8 x 2 2/5 =

8. 3 1/2 x 8/9 =

9. 2 1/3 x 1 1/2 =

10. 1 4/5 x 6 2/3 =

Solutions: **1.** 2/15 **2.** 25/48 **3.** 2 2/5 **4.** 2/21 **5.** 2 1/4 **6.** 11 1/2 **7.** 1 1/2 **8.** 3 1/9 **9.** 3 1/2 **10.** 12

Fractions – Division **Handout #13**

1. $4/5 \div 1/3 =$

2. $2/7 \div 3/4 =$

3. $4 \div 4/5 =$

4. $2/3 \div 5/6 =$

5. $7/12 \div 3 =$

6. $2 \div 1\ 1/7 =$

7. $5/8 \div 1\ 5/6 =$

8. $3\ 3/4 \div 3/10 =$

9. $1\ 2/5 \div 2\ 1/4 =$

10. $4\ 1/4 \div 1\ 1/2 =$

Solutions: **1.** 2 2/5 **2.** 8/21 **3.** 5 **4.** 4/5 **5.** 7/36 **6.** 1 3/4 **7.** 15/44 **8.** 12 1/2 **9.** 28/45 **10.** 2 5/6

Write the place value of each underlined digit:

1. 24.3<u>5</u>6

2. 3.<u>7</u>8

3. .49<u>1</u>

4. 267.<u>3</u>259

5. 14.173<u>6</u>

6. 5.7<u>0</u>84

7. 4.1<u>7</u>

8. .25<u>6</u>

9. 2.<u>0</u>9

10. 6.80<u>5</u>

Solutions: **1.** 5 x 1/100 **2.** 7 x 1/10 **3.** 1 x 1/1,000 **4.** 3 x 1/10 **5.** 6 x 1/10,000 **6.** 0 x 1/100 **7.** 7 x 1/100 **8.** 6 x 1/1,000 **9.** 0 x 1/10 **10.** 5 x 1/1,000

Decimals -- Addition **Handout #15**

1. 3.726 + 4.915 =

2. 28.467 + 37.29 =

3. 35.2 + 41.84 =

4. 15.93 + 4.895 =

5. 8.45 + 15.316 =

6. 3.7 + 14.24 + 2.3 =

7. 24.81 + 35.7 + 28.274 =

8. 12 + 5.88 =

9. 2.43 + .57 + 3.18 =

10. .3 + 21.508 + 3.4 =

Solutions: **1.** 8.641 **2.** 65.757 **3.** 77.04 **4.** 20.825 **5.** 23.766 **6.** 20.24 **7.** 88.784 **8.** 17.88 **9.** 6.18 **10.** 25.208

Decimals -- Subtraction **Handout #16**

1. 17.368 - 8.415 =

2. 24.28 - 13.7 =

3. 12.05 - 6.8 =

4. 74.3 - 51.42 =

5. 93.26 - 14.336 =

6. 8.4 - .31 =

7. 14.8 - 6.753 =

8. 67.31 - 49.826 =

9. 57.43 - 29.5 =

10. 12.6 - 8.897 =

Solutions: **1.** 8.953 **2.** 10.58 **3.** 5.25 **4.** 22.88 **5.** 78.924 **6.** 8.09 **7.** 8.047 **8.** 17.484 **9.** 27.93 **10.** 3.703

Decimals -- Multiplication **Handout #17**

1. 13 x .4 =

2. 9.1 x 8 =

3. 12.3 x .5 =

4. 1.04 x .07 =

5. .75 x 11 =

6. 136 x .006 =

7. 128 x .2 =

8. 17.3 x 1.6 =

9. .42 x .03 =

10. 2.05 x .9 =

Solutions: **1.** 5.2 **2.** 72.8 **3.** 6.15 **4.** .0728 **5.** 8.25 **6.** .816 **7.** 25.6 **8.** 27.68 **9.** .0126 **10.** 1.845

Decimals -- Division **Handout #18**

1. $2.82 \div 6 =$

2. $5.67 \div 9 =$

3. $110.5 \div 13 =$

4. $1.224 \div 4 =$

5. $.882 \div 21 =$

6. $.001 \div .5 =$

7. $.0248 \div .08 =$

8. $1.0236 \div .12 =$

9. $.105 \div .06 =$

10. $.51 \div .012 =$

Solutions: **1.** .47 **2.** .63 **3.** 8.5 **4.** .306 **5.** .042 **6.** .002 **7.** .31 **8.** 8.53 **9.** 1.75 **10.** 42.5

Math I -- Post-Assessment **Name:**_____ **Date:**_____

1. 3/4 + 2/3 =

2. 2/3 - 3/5 =

3. 3 3/4 + 2 4/5 =

4. 4 1/3 - 2 1/2 =

5. 8/9 x 3/16 =

6. 5/8 ÷ 3/4 =

7. 57.3 + .009 =

8. 161.015 - .61 =

9. 14.2 x .75 =

10. 112.5 ÷ 4.5 =

CURRICULUM NOTES:

The topics within the syllabus are very focused and serve as remedial tools for students with weak basic math skills in Math II and Algebra. Although a lesson plan may contain several topics for an entire two-hour class, the instructor may choose additional single-sheet topics on a very selective basis for students who need help in specific areas. This will reduce the heterogeneity of the class, making it easier to teach the group as a whole.

REFERENCES

Kaufmann, Jerome. *Elementary Algebra for College Students*. Boston: PWS-Kent, 1992

Slator, Jeffrey, and Tobey, John. *Basic College Mathematics*. Englewood Cliffs: Prentice Hall, 1991.

Yamato, Yoshiko, and Cordon, Mary Jane. *Mastering Mathematical Concepts*. San Diego: Harcourt Brace Jovanovich, 1991.